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UNIVERSITY OF ALBERTA

THE USE OF MENTAL VERBS IN AUTISTIC INDIVIDUALS

BY

SHARON STOROSCHUK

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR

THE DEGREE OF MASTER OF SCIENCE

IN

PSYCHOLINGUISTICS

DEPARTMENT OF LINGUISTICS

EDMONTON, ALBERTA

SPRING, 1992

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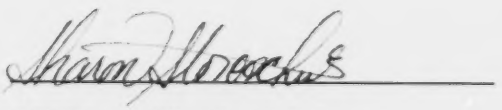

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ABSTRACT

Expressive language samples of four groups were examined for their use of mental verbs to describe mental states and for their use in conversational functions. The four groups consisted of 30 higher and lower functioning autistic children and adults, matched with their respective control groups (15 nonhandicapped and 15 non-autistic, mentally handicapped children and adults) on mean length of utterance, chronological age and verbal IQ. The mental verbs were coded for five functions: mental state, modulation of assertion, directing the interaction, clarification, and idiomatic expressions. Significant differences were found between the higher functioning autistic and nonhandicapped groups, and between the lower functioning autistic and mentally handicapped groups for the mental state function. This indicates that autistic individuals use mental verbs less often than others to describe mental states, regardless of developmental level, and therefore, this deficit in describing mental states may be autism specific. No significant differences were found for the number of mental verbs used in the conversational functions. Use of mental verbs to describe mental states was related to verbal ability (verbal IQ or mean length of utterance) in all groups.

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Chapter I

Introduction

Human beings have the ability to attribute beliefs and knowledge to others, to form metarepresentations, or, representations of representations. The ability to represent representations allows us to make inferences about behaviors of others. For example, if we see a man walk out of his house towards his car, but stop and feel his pockets, only to turn around and go back inside and reappear, we could infer that he left his car keys in the house. We can take the other person's point of view and draw inferences about what might have just occurred and what might occur. What enables us to do this?

One hypothesis is that people have a "theory of mind," that is, an innate cognitive ability to attribute mental states to oneself and to others. This hypothesis stems from the theory that humans have the capacity to form metarepresentations (Leslie, 1987) and infer thoughts, beliefs, and knowledge to others and to oneself (Baron-Cohen, 1990, 1991; Baron-Cohen, Leslie, & Frith, 1985). Another hypothesis, is that it is executive functioning or, "the ability to maintain an appropriate problem solving set for attainment of a future goal" (Ozonoff, Pennington & Rogers, 1991, p. 1083) that may somehow be related to our

ability to represent mental states. This hypothesis comes from the field of neuropsychology. A third hypothesis states that it is primarily through the development of emotions and interpersonal relationships, that human beings are able to understand the behavior of others and to take another person's point of view (Hobson, 1990a, 1991a, 1991b). From these three different hypotheses, someone who lacks the ability to take the perspective of another person or themselves could be said to lack the very core of being human. An example of such a person is someone with autism. Individuals with autism are characterized by severe impairments in reciprocal social skills. They lack the ability to attribute mental states to others and to themselves, and to represent another person's point of view. These deficits are evident in autistic individuals' social and language impairments and other behavioral difficulties that interfere with opportunities for them to be independent members of society.

Recently, there has been a great deal of interest in the proposal that persons with autism have a very specific deficit in 'theory of mind' (Baron-Cohen, 1990; Leslie, 1987). An opposing view is Hobson's affective theory of autism, which sees this inability as part of a more general deficit in social relations (Hobson, 1990a, 1990b, 1991a, 1991b). Recently, Ozonoff and colleagues (1991) have

suggested that a deficit in executive functioning is related to deficits in theory of mind ability. All three theories aim to explain the social and language impairments associated with autism.

One way of operationalizing these competing theories is to observe the most important form of representation in humans, language. A primary deficit in "theory of mind" should have very specific effects on how autistic children use mental verbs; that is, verbs like know, think, guess, or understand, that describe their mental states or the mental state of someone else. If persons with autism are unable to attribute mental states to themselves or others, they should have specific difficulties in using terms to describe their own or others' mental states. In contrast, a theory of autism as a primarily affective or more general cognitive deficit (Rutter, 1983) would predict broader deficits in other aspects of language or social interaction.

The present study investigates whether or not autistic children, adolescents and young adults use mental verbs to describe mental states and to carry out other pragmatic functions with the same frequency as nonautistic populations at equivalent language and cognitive levels. Expressive language samples were scored from transcripts of a semi-structured interview conducted in a conversational style. Differences in the frequency of use of mental verbs to serve

conversational functions and those used to describe mental states are investigated in two samples of verbal autistic children and adults (higher and lower functioning autistic), a matched nonautistic mentally handicapped sample, and a nonhandicapped sample.

The research questions are, specifically, how do autistic individuals compare to nonhandicapped and handicapped individuals matched on verbal IQ, mean length of utterance and chronological age for 1) frequency of use of mental verbs and, 2) use of these mental verbs in the five functions: mental state, modulation of assertion, directing the interaction, clarification, and idiomatic expressions?

Chapter II

Literature Review

What is autism?

Kanner (1943) first described cases of autism in children as an affective disorder in which "these children have come into the world with [an] innate inability to form the usual, biologically provided affective contact with people, just as other children come into the world with innate physical or intellectual handcaps" (p. 250, Kanner, 1943). Today, autism is defined as a lifelong pervasive developmental disorder with deficits in two major areas: social behavior and communication; plus the presence of repetitive or stereotyped interests or behaviors. According to the DSM-IV (1991) and ICD-10 (WHO, 1987) drafts, criteria must be met in each of the three areas, with an age of onset prior to 36 months. Autism affects 3-4 per 10,000 persons, with prevalence estimates as high as 10-12 per 10,000 when criteria are broadened slightly. There is a 3 or 4 to 1 ratio of males to females. Three quarters of autistic children are estimated to function within the range of mental retardation on nonverbal skills, with verbal abilities typically even more deficient. About half of autistic children are functionally without speech (Lord & Rutter, in press).

The social deficits of autism are most noticeable in impaired relationships. As shown in Table 1, these are manifest in the autistic person's lack of awareness of social cues, lack of response to others, and lack of socio-emotional reciprocity. Details of the communication deficit are discussed below. The third set of criteria is concerned with various types of restricted, repetitive and stereotyped patterns of behavior and interests (Lord & Rutter, in press).

Table 1 about here

Autism and language development

The language deficits in autism do not involve primary impairments in grammatical ability, but occur in communication skills, or the social use of language. Linguistic aspects such as syntax and phonology are the least impaired areas in autism, and pragmatics the most impaired area (Bartolucci, 1982; Tager-Flusberg, 1981, 1985, 1990). Phonological development does not appear to be impaired in most verbal autistic children, but may be delayed (Bartolucci & Pierce, 1977). Some syntactic rules employed by autistic children in spontaneous speech are less complex than expected (Bartolucci, 1982) including specific delays in morphology in relation to deixis (Bartolucci &

Table 1

Impairments in autism according to ICD-10 (WHO, 1987) criteria

Social impairments:

a) poor quality of eye gaze, lack of facial expression, body posture, and gesture to regulate social interaction;

b) rarely seeking others for comfort or affection;

c) rarely initiating interactive play with others;

d) rarely offering comfort to others or responding to other people's distress or happiness;

e) rarely greeting others;

f) no peer friendships in terms of a mutual sharing of interests, activities, and emotions.

Language impairments:

a) lack of babbling, facial expression, gesture or imitation as an infant;

b) abnormal eye contact, facial expression, gesture to initiate or modulate social interaction;

c) absence of pretend or imaginative play;

d) abnormalities in speech production, such as volume, pitch, stress, rate, rhythm and intonation;

e) stereotyped and repetitive use of speech such as

Table 1 (cont.)

immediate and delayed echolalia, and idiosyncratic use of speech and ritualistic speech;

f) impairment in the ability to initiate or sustain a conversation;

g) pronominal reversal specifically the use of "you" for "I".

Restricted, repetitive and stereotyped patterns of behavior:

a) an encompassing preoccupation with stereotyped and restricted patterns of interest,

b) attachments to unusual objects,

c) compulsive rituals,

d) stereotyped and repetitive motor mannerism,

e) preoccupations with part-objects or non-functional elements of play materials,

f) distress over changes in small details of the environment.

Albers, 1974). However, overall, syntax is relatively intact for most autistic individuals, compared to other areas of language (Tager-Flusberg, 1985, 1990). Semantics has not been studied much in autism, but the autistic child's expressions of semantic categories has been found to be restricted compared to normal children with similar syntactic development (Bartolucci, 1982). According to a number of researchers, pragmatic development is the most impaired aspect of language (Baltaxe, 1977; Baron-Cohen, 1988; Tager-Flusberg, 1981; Watson, Martin & Schaffer, 1986). The autistic individual's abnormal communication abilities are manifested in impairments in initiation of conversation, sustaining a conversation, turn-taking, the ability to take another's point of view, using gestures and facial expression, and greeting (Baron-Cohen, 1988; Watson, et al., 1986).

Language comprehension is also impaired in the autistic child from an early age (Lord, 1985). If children's attention to the world helps them learn language, then the autistic child is at a loss from the beginning insofar as he/she does not make eye contact, express variability in facial expression, or use gestures and imitation, all the socializing 'tools' normal infants have to indicate that they comprehend the world around them. These deficits impair their interactions with caregivers and their learning

of language. Abnormalities are also present in the speech of verbal autistic children. Many autistic children exhibit immediate and delayed echolalia, idiosyncratic use of words and sentences, neologisms, pronoun reversals, and odd voice quality (Watson, Lord, Schaffer, & Schopler, 1989; Volden & Lord, 1991). Preoccupations with unusual objects, or use of objects in unusual manners may also affect social interactions.

Explaining autism: Specific versus general deficits

In recent years, it has been suggested that autism is a cognitive disorder (Baron-Cohen, 1990; Rutter, 1983). In an attempt to specify the cognitive deficit in autism, some researchers have investigated the impaired ability of autistic persons to attribute mental states to themselves and to other people (Baron-Cohen, 1990, 1991; Leslie, 1987). This ability is frequently referred to as a 'theory of mind,' a term coined by Premack and Woodruff (1978, as cited in Baron-Cohen, 1990). They define it as follows:

> In saying that an individual has a theory of mind, we mean that the individual imputes mental states to himself and others... A system of inferences of this kind is properly viewed as a theory, first because such states are not directly observable, and second, because the system can be used to make predictions,

specifically about the behavior of other organisms. (p. 515)

Baron-Cohen (1990) proposes that a specific cognitive abnormality in autistic people accounts for the social deficits seen in autistic children and adults. He tested this hypothesis using an adaptation of Wimmer and Perner's (1983, as cited in Baron-Cohen, 1990) test of children's understanding of false belief. In Baron-Cohen's task, Sally (a doll) places her marble in a basket in the presence of both examiner and child, and then leaves the room. Anne (another doll) transfers Sally's marble to a box on the table. Sally reenters, and the examiner asks the child, "Where will Sally look for her marble?" Normal four year-old children are able to answer correctly that Sally will look in the basket where she (Sally) believes the marble to be. Baron-Cohen and colleagues (Baron-Cohen, et al., 1985) found that 86 percent of the 14 children with Down syndrome (mean verbal mental age=2 years, 11 months) and 85 percent of the 27 normal children (mean chronological age=4 years, 5 months), but only 20% of the 20 higher functioning autistic children (mean verbal mental age=5 years, 5 months), were able to answer correctly. Most of the autistic children replied that Sally would look in the box, where Ann had put the marble. These results have been replicated many times using similar paradigms ranging from appearance-reality

tasks to second-order belief attribution tasks (see Baron-Cohen, 1990 for a review; Frith, 1989). These investigators claim that the lack of a theory of mind is autism-specific because other areas of social cognition, such as person permanence, visual perspective-taking, mirror self-recognition, and gender recognition, seem to be intact in autistic children (Baron-Cohen, 1991).

In another study, Baron-Cohen (1991) investigated whether or not autistic children have different levels of understanding of a range of mental states (perception, desire, imagination, pretence, and belief), and if so, whether these abnormalities indicate a deficit or merely a delay (Baron-Cohen, 1991). Using a task involving the recall of the subjects' own mental states, he found that all 15 autistic children (mean verbal mental age=6.2 years) were able to recall perception, 80 percent desire, 60 percent imagination, 47 per cent pretence and only 26 per cent belief. The performance of the autistic group was significantly impaired compared to the control groups (normal and Down syndrome) in recalling mental states in response to questions about imagination, pretence, and belief.

These results were interpreted as indicating both a delay and a deficit in development, because 1) the autistic children were older than the normal group (mean

chronological age in years was 15.3 for the autistic, 15.44 for the mentally handicapped, and 4.1 for the normal children), supporting the influence of a general delay; and 2) the suggested sequence of development reported by Gopnik & Slaughter (in press, as cited in Baron-Cohen, 1991) in normally developing children is pretence, perception, imagination, desire and belief, but the autistic group seemed to progress through a different sequence in the understanding of the mental states. These studies suggest that there may be an autism-specific cognitive deficit in the development of a theory of mind. The theory of mind hypothesis stems from Leslie's (1987) computational model of the cognitive processes underlying metarepresentation that lead to the ability to pretend. Leslie (1987) suggests that it is the capacity for metarepresentation that drives the theory of mind and limits the abilities of individuals with autism.

An alternative theory to explain the social deficits in autism proposes that children must first develop an awareness of people through the experience of reciprocal personal relations before they can make inferences about the existence of mind in others. Children interpret the world, and through their own subjectivity, become able to represent the world symbolically and engage in imaginary thought (Hobson, 1990a). According to Hobson (1990a), autistic

children have primary social-affective incapacities that cause an inability "to adopt multiple orientations to given objects or events" (Hobson, 1990a, p. 118). This deficit results in the characteristic cognitive and linguistic impairments found in autistic children, including their difficulties in 'theory of mind' tasks (Hobson, 1990a).

In contrast, Ozonoff and colleagues (1991) propose a cognitive theory, in which the impairments found in autism may be explained by multiple primary deficits. Specifically, they investigated whether or not deficits in theory of mind, emotion perception and executive functioning might be involved. Executive functioning is the ability to attain a future goal by using problem solving strategies like planning, impulse control, inhibition of prepotent but irrelevant responses, set maintenance, organized search, and flexibility of thought and action (Ozonoff et al., 1991). In autistic children, this deficit is most evident in their rigidness and inflexibility over changes in routines or environment, repetitive and stereotyped behaviors, and lack of understanding of future goals or consequences.

Ozonoff and colleagues (1991) tested 23 higher functioning autistic children (mean verbal IQ=82.91) and a control group on a battery of perception, theory of mind and executive function measures, as well as discriminant tasks of memory and spatial ability. They found a difference in

the autistic and nonautistic groups' performance for the executive functioning, theory of mind and verbal memory tasks, with the autistic group performing poorly. In fact, all of the autistic subjects were impaired in executive functioning, but only a subset were impaired in theory of mind. Further analyses showed that some abilities (e.g. executive functioning, social cognition and IQ) that were unrelated in the non-autistic control group were associated in the autistic individuals, suggesting that normally independent dimensions of functioning may be related and interdependent within autism, although why and how this occurs, remains to be uncovered. While deficits in theory of mind and emotion perception were more widespread in the autistic participants, their presence in some non-autistic participants suggests that these deficits are not specific to autism. These researchers propose that underlying abnormalities in prefrontal functioning may contribute to the cognitive and affective deficits seen in autism, specifically, deficits in theory of mind ability and executive functioning.

Studies on use of mental verbs

One way the development of a theory of mind is evident is in the acquisition of mental state terms in language. This development occurs around the third year of life in

normally developing children, "At the end of the first year, young children progress to an explicit, verbally expressible theory of mind that begins to emerge at the end of the second year" (Bretherton, McNew & Beeghly-Smith, 1981, p. 356). Studies have found that mental verbs appear first as part of conversation in the second half of the third year, followed by use of mental verbs to refer to mental states (Bretherton & Beeghly, 1982; Shatz, Wellman, & Silber, 1983).

Shatz and colleagues (1983) carried out two longitudinal studies to determine the sequence of acquisition of mental verbs in normally developing children. The first study followed one child from 2 to 4 years of age, and the second study followed 30 children for 6 months during their third year of life. In both studies, naturalistic samples of speech from interactions of children and their caregivers were analyzed. Speech samples were transcribed and investigators coded occurrences of mental verbs into seven functions: 1) mental states, referring to the thoughts, memories or knowledge of the speaker, listener, or a third person; 2) modulation of assertion, marking the degree of certainty with which a speaker makes an assertion, by either weakening or strengthening it; 3) directing the interaction, aiding the interaction or focusing the conversation by gaining attention, introducing

or getting information, or introducing an activity; 4) clarification, clarifying or repairing an utterance; 5) expression of desire, usually paraphrased as want, and including verbs such as wish or hope; 6) action-memory, referring to actions or the omission of actions; and 7) "I don't know" , a phrase most frequently used in an idiomatic way without a predicate complement.

Shatz and colleagues (1983) found that frequency and variety of mental verbs increased with age in both the longitudinal and cross-sectional studies. Know and think were the most commonly used mental verbs. Mental verbs were first used for idiomatic functions (e.g., saying "I don't know") or in pragmatic social routines used to focus and direct conversation, while modulation of assertion and references to mental states appeared later. Overall, about one percent of utterances contained a mental verb, and utterances with a mental verb used to describe a mental state were more likely to be grammatically complex than utterances with mental verbs used for other functions.

Tager-Flusberg (1992) carried out a similar longitudinal study comparing six autistic children to six children with Down syndrome on their use of lexical terms placed in four categories: desire, perception, emotion and cognition. The psychological terms used in each category were coded to distinguish conversational uses from reference

to mental states. Codes used for cognitive lexical terms (these were noun, adjective and verb word roots, similar to the mental verbs in Shatz et al., 1983) were the same as those employed by Shatz et al. (1983). Tager-Flusberg found that autistic children used cognitive terms less frequently than the Down syndrome children.

Together, the autistic children in Tager-Flusberg's study used a total of eight different cognitive terms whereas the children with Down syndrome used 14. The autistic children used significantly fewer cognitive terms per utterance in the mental state function than did the children with Down syndrome, but there were no differences in use of cognitive verbs for conversational functions. The order of acquisition of cognitive terms was found to be the same for the autistic and Down syndrome children; that is, they first used them in idiomatic and conversational ways and later described mental states.

Several problems with this study, including the small sample size, make the results difficult to generalize. The autistic sample was not homogeneous; the IQ range (61 to 108) was very large with a mix of higher and lower functioning autistic children. Data are pooled across different children at different ages so that it is not possible to determine how much a particular result is dependent on one or two children. As well, Tager-Flusberg

(1992) had no nonhandicapped participants to compare with her handicapped samples. She suggested that impairments of cognitive states leads to difficulties in social understanding and relationships, supporting lack of a "theory of mind" as a primary deficit in autism (Baron-Cohen, 1990).

Eisenmajer and Prior (1991) studied 29 high functioning autistic participants (verbal mental age=7 years, 5 months) and compared their scores on false belief tasks to cognitive measures (similarities, comprehension and vocabulary subtests from the WISC-R) and a pragmatic skills test. Thirty-eight per cent of their autistic subjects attributed a false belief to another person and showed knowledge of another person's ignorance. This proportion of "passes" by autistic participants is much higher than studies by the British group using the same task (20 per cent, Baron-Cohen, 1985; 28 per cent, Leslie & Frith, 1988, as cited in Eisenmajer & Prior, 1991). Eisenmajer & Prior attribute this discrepancy to the high mental ages of their participants and suggest that verbal skills influence performance on tasks used to test for a "theory of mind." Performance on false belief tasks was also found to be related to verbal comprehension ability in another study (Prior, Dahlstrom & Squires, 1990).

Eisenmajer and Prior (1991) also found that performance

in a test of pragmatic skills was strongly associated with success on the false belief task. In order to initiate a conversation, respond appropriately to different people, take turns, and distinguish new from old information and use it accordingly in a conversation, "a speaker must continually assess and have beliefs regarding what the listener knows, does not know, wants to know and needs to know. Pragmatic competence would thus appear to require an appreciation of the mental states of others" (Eisenmajer & Prior, 1991, p.353).

Instead of the all or none proposition described in Baron-Cohen's theory of mind (1990, 1991) and Leslie's metarepresentational model (Leslie, 1987), Prior and colleagues (Eisenmajer & Prior, 1991; Prior et al., 1990) suggest a continuum of theory of mind ability reflecting a developmental sequence of metarepresentational skills. Their study showed a relationship between developmental factors, especially pragmatic skills, and development of theory of mind abilities. This gives rise to the question of whether the failure of autistic children to use mental verbs is related to language-related difficulties in producing and understanding such terms, or to their inability to attribute the actual mental states to themselves and others.

Design of present study

The present study is designed to investigate autistic children's use of mental verbs in expressive language. It is hypothesized that if impairments in language and social development resulting in abnormal communication are due to a specific deficit in theory of mind, autistic children should use mental verbs to describe mental states less frequently than control groups, but be unimpaired in the use of mental verbs for conversational functions. Using the coding system developed by Shatz and colleagues (1983), frequency of use of mental verbs to describe mental states versus their conversational use is investigated in the spontaneous, expressive language of 60 autistic, mentally handicapped and normally developing children and adults. Results will indicate the extent to which autistic individuals have a specific deficit in "theory of mind" and, if so, identify factors that are associated with this deficit.

Chapter III

Method

This study assessed the frequency of use of mental verbs to describe mental states in the expressive language of four groups: 1) higher functioning autistic children, 2) non-handicapped children, 3) lower functioning autistic children, and 4) non-autistic mentally handicapped children.

Participants

Sixty participants were selected from 84 children and adults who participated in a previous study (Volden & Lord, 1991) according to verbal IQ (VIQ; WISC-R or WAIS-R; Weschler, 1974, 1981), chronological age (6 -25 years), and mean length of utterance (MLU; Brown, 1973). Mean length of utterance was chosen as a measure of expressive language ability. Only participants with a mean length of utterance above 3.00 (Brown's (1973) stage IV) were included because pilot work indicated that instances of mental state verbs were extremely rare below this level of expressive language ability. All participants came from homes in which the native language was English.

The autistic participants were recruited from clinics for communication disordered or autistic persons in three locations: Alberta, (Canada), North Carolina, (United

States), and London, (England) (see Volden & Lord, 1991). All met DSM-III-R (APA, 1987) and ICD-10 draft (WHO, 1987) diagnostic criteria as judged independently by a child psychologist (Dr. Catherine Lord) and a child psychiatrist (Dr. Allen Carroll). Autistic participants also met research diagnostic criteria on two measures: the Childhood Autism Rating Scale (CARS; Schopler, Reichler & Renner, 1986) and the Autism Diagnostic Interview (ADI; Le Couteur et al., 1989).

Non-autistic, mentally handicapped participants were recruited on the basis of chronological age, sex, and IQ from special classrooms and schools for the mentally handicapped. Children with any previous diagnoses of autism or pervasive developmental disorder or sensory or physical handicaps were excluded from the school registers prior to participant selection. Nonhandicapped participants (those not mentally handicapped and not autistic) were recruited from summer daycamps and schools that the autistic children attended.

As shown in Table 2, the 60 participants composed four groups: 15 (10 males, 5 females) higher functioning autistic participants, 15 (9 males, 6 females) nonhandicapped, 15 (7 males, 8 females) lower functioning autistic, and 15 (10 males, 5 females) nonautistic, mentally handicapped children and adolescents. The four groups were matched on

chronological age. As shown in Table 2, the participants were also group-matched so that the higher-functioning autistic group was equivalent to the nonhandicapped group, and the lower functioning autistic group equivalent to the mentally handicapped group on mean length of utterance (MLU). Verbal IQ for the nonhandicapped group was not assessed but was assumed to be normal, with a mean of 100. The participants in the higher functioning autistic group were matched on verbal IQ as closely as possible to the estimated verbal IQ of 100 of the nonhandicapped participants. The lower functioning autistic group was matched as closely as possible to the nonautistic, mentally handicapped group on verbal IQ. There were no significant differences between the higher functioning autistic and nonhandicapped groups for mean length of utterance ($\underline{t}(28)=0.095$, $p<0.4$), chronological age ($\underline{t}(28)=0.13$, $p<0.4$), and total number of utterances ($\underline{t}(28)=1.01$, $p<0.1$). And no significant differences between the lower functioning autistic and mentally handicapped groups for mean length of utterance ($\underline{t}(28)=0.175$, $p<0.4$), chronological age ($\underline{t}(28)=1.25$, $p<0.1$), verbal IQ ($\underline{t}(28)=1.34$, $\underline{p}<0.10$), and total number of utterances ($\underline{t}(28)=0.049$, $\underline{p}<0.4$).

Table 2 about here

Table 2

Descriptive information for participants matched on mean length of utterance

(n=15 for each group)

Group	Mean length of utterance	Verbal IQ	Chronological age (years;months)	Total No. utterances
Higher autistic				
M	7.06	99.1	13;10	155
sd	2.10	16.3	5;9	60.8
range	(3.92-10.93)	(85-146)	(6;9-25;7)	(75-281)
Nonhandicapped				
M	7.00		13;7	131
sd	1.25		5;0	69.5
range	(4.48-8.72)		(5;0-22;5)	(50-276)
Lower autistic				
M	4.49	63.3	15;2	103
sd	1.06	12.5	5;2	68.8
range	(3.49-7.55)	(45-78)	(9;0-29;10)	(24-209)
Mentally handicapped				
M	4.56	57.9	13;4	102
sd	1.14	9.4	2;5	39.8
range	(3.20-6.55)	(45-72)	(9;5-16;9)	(36-165)

Assessment Procedures

Transcripts of videotaped Autism Diagnostic Observation Schedule (ADOS, Lord et al., 1989) interviews were used for analysis. The Systematic Analysis of Language Transcripts (SALT) program (Miller & Chapman, 1983; Brown, 1970) was used to analyze the transcripts. This is a computer program that generates psycholinguistic measures from transcripts, such as mean length of utterance and number of utterances, as well as counts any flagged items. Mean length of utterance, as used here, was computed in terms of morphemes for complete and intelligible utterances as calculated by SALT. The ADOS was administered as part of a study by Lord et al. (1989); ADOS interviews were videotaped and four trained researchers (Heather Jordan, Cathy Malloy, Lynn Anderson, and the author), blind to diagnosis, transcribed the tapes in standard English. Rater pairs obtained a minimum reliability of 90% agreement computed morpheme by morpheme for three consecutively coded videotapes and 2-4 other independently transcribed tapes throughout the months of coding. The transcripts were then analyzed using the SALT program (Miller & Chapman, 1983).

The ADOS interview consists of two parts. The first part includes specific tasks, such as construction, make-believe play, joint interactive play, a drawing game, a demonstration, describing a poster, and telling a sequential

story. The second part consists of unstructured social interaction, description of emotions and conversation. The data used in this study consisted of the second part of the ADOS, approximately 10 - 15 minutes in length. The first part was excluded because its structure did not facilitate much spontaneous speech. In the second part, conversation was less structured and allowed to occur in a way that allowed for spontaneous discussion. Participants also provided answers to a hierarchy of questions ranging from specific to very general, open questions. The examiner asked the participants about their emotions, their understanding of the qualities of persons close to them, their concept of friendship, and their ideas about opposite-sex friendships and marriage (see appendix A for examples of the questions asked).

Coding Procedures

Two coders (the author and Susan Jaedicke, a graduate student in developmental psychology) identified all the mental verbs in the transcripts, based on a list provided by Shatz, Wellman, & Silber (1983). These verbs are listed in Table 3. Emotion verbs (e.g., worry) were excluded if they were a direct result of specific questions about emotions, but included if they occurred spontaneously. Only participants' initial use of mental verbs were coded.

Repetitions, defined by presence of the same mental verb in the same or a previous turn of the participant or examiner, were excluded. For example, in the following utterances by one participant, "And you know, just having that best friend almost. Just that, you know, you can do fun things with...", the second use of the mental verb know would be excluded and only the first use coded.

Table 3 about here

Definitions

The mental verbs were then coded according to function, determined by the context of the utterance, using a modified version of the procedure employed by Shatz et al. (1983). Five function codes were used to classify the mental verbs: mental state, modulation of assertion, directing interaction, clarification, and idiomatic expressions. These are defined as follows:

(1) Mental state. Mental state words were those verbs used to refer to the thoughts, memories or knowledge of the speaker, listener or a third person. Examples: "I wonder if Sundre has a lake," "I'm going to have to decide," "I wish the Transformer show came on," "To be able to trust each other and tell our problems," "And I've accepted that."

Table 3

List of mental verbs used

by the participants

know	imagine	think	reckon
guess	recognize	mean	trust
understand	accept	decide	agree
worry	assume	forget	disagree
hope	doubt	remember	learn
wish	perceive	figure	prefer
suppose	realize	wonder	recall
expect			

(2) Modulation of assertion. These were words used to strengthen or weaken an assertion. Examples: "So I guess it's just myself at home", "I mean Kinik weighs more than she does", "How it gets cold I bet is because all the cold mountain streams."

(3) Directing interaction. This category included words that focused the conversation or aided in its flow. The most common types were: a) gaining attention, example, "I hope I'm doing okay here"; b) introducing or obtaining information, for example, "You know what happens"; c) expressing desire, example, "I hope I'm doing alright" (participant asks examiner for feedback on answers to questions.) (The latter type was a separate function category in the original article by Shatz et al. (1983), but was not coded separately in this study because all mental verbs identified as such, fell either into the category of directing interaction or mental state).

(4) Clarification. These words were used to clarify an utterance or to ask for clarification. The word used most commonly was mean, for example: "I mean she gets mad at me and my sister when we don't want to do anything" (used to clarify who she gets mad at - "me and my sister.")

(5) Idiomatic expressions. These were words in utterances that were used in idiomatic ways. Included were, "I don't know," "I know," "you know," "don't know," and "If you know what I mean." These utterances were usually answers to questions.

(See Appendix B for more examples).

Reliability

After training and discussion, ten transcripts were randomly selected to assess the reliability of the coding procedure. Reliability for coding of verb function was 89% verb by verb agreement between the two coders. Cohen's kappa was calculated at 0.82. Disagreements were resolved through discussion.

Analysis of the data

The number of mental verbs used in each function for each participant were calculated. The nonhandicapped participants were compared with the higher functioning autistic participants, and the mentally handicapped participants were compared with the lower functioning participants. Also, the frequency of use of the mental verbs for each function were related to the verbal IQ, chronological age, and mean length of utterance of each participant.

Limitations of the study

The major limitation of this study is that it focuses on autistic individuals with verbal ability even though half of autistic individuals have no speech. This limits any conclusions that are made about autism, but it is important for research that includes verbal autistic individuals. It may also have implications for those studies that do not address verbal ability, yet include both verbal and nonverbal autistic individuals.

Also, in considering descriptions of mental states it would be interesting to investigate whether the mental states used referred to those of the participants or of others. Unfortunately, this is not included in this study, but is presently being carried out by the author as a separate study.

Sample size also limited this study in that statistical analysis was not as powerful as with a larger sample size, and makes generalizations more difficult.

Despite the limitations of this study, it is important to replicate studies of normal children to compare the results to abnormal populations for insight, especially if they contribute to explanations of theories used to explain the deficits causing such disorders.

Chapter IV

Results

Description of mental verbs used

Higher functioning autistic participants

The higher functioning autistic group produced a total of 2336 utterances, containing 184 mental verb tokens. Of these, 61 were used to describe mental states. The verbs used most frequently in this function were know (22 times) and think (14 times). Forty-four of the total mental verbs were used for directing the interaction, with know being the most frequently used verb in this function (32 times). Forty-two were used for modulation of assertion, with think and guess being the most frequently used verb in this function (15 times each). Eight were used for clarification, with mean being the only verb used in this function (7 times). Twenty-nine instances occurred in idiomatic expressions, with know being the only verb used in this function.

Table 4 about here

Nonhandicapped participants

The nonhandicapped group produced 1860 utterances, containing 169 instances of the mental verbs as shown in

Table 4

Mental verb tokens

Total Number	Non-handicapped	Higher autistic	Lower handicapped	Mentally handicapped
Utterances	1860	2336	1538	1540
Mental verbs used	169	184	59	55
MV used in mental state function	71	61	9	21
MV used in directing interaction function	42	44	7	5
MV used in modulation of assertion function	30	42	6	3
MV used in clarification function	2	8	0	4
MV used in idiomatic expression function	24	29	37	22

Table 4. Of these, 71 were used to describe mental states. The verbs used most frequently in this function were know (18 times) and think (13 times). Forty-two of the total mental verbs were used for directing interaction, with know being the verb most frequently used (39 times). Thirty were used for modulation of assertion, with guess being the verb most frequently used (13 times). Two were used for clarification, mean was the only verb used for this function. Twenty-four instances occurred in idiomatic expressions, with know as the most frequently used verb (23 times) (see Table 4).

Lower functioning autistic participants

The lower functioning autistic group produced a total of 1538 utterances, containing 59 mental verb tokens. Nine of the instances of mental verbs described mental states. The verb used most frequently in this function was know (6 times). Seven of the total mental verbs were used for directing the interaction, with know being the verb used most frequently in this function (5 times). Six were used for modulation of assertion, with think and guess being the verbs used most frequently in this function (twice each). No verbs were used in the clarification function. Thirty-seven instances occurred in idiomatic expressions, with know being the verb used most frequently (36 times).

Non-autistic mentally handicapped participants

The nonautistic mentally handicapped group produced 1540 utterances containing 55 mental verb tokens. Twenty-one of the instances of mental verbs described mental states. The verb used most frequently in this function was know (11 times). Five of the total mental verbs were used for directing interaction, with know and think being the verbs used most frequently (twice each). Three were used for modulation of assertion, with think being the only verb used in this function. Four were used for clarification, with mean being the only verb used in this function. Twenty-two instances occurred in idiomatic expressions, with know being the only verb used in this function.

The four groups used a total of 29 different mental verbs. The nonhandicapped group used 23 different verbs, the higher functioning autistic group 22, the nonautistic mentally handicapped group 8, and the lower functioning autistic group 6 (Table 5). As shown in Table 5, the most frequent verbs used by all four groups were know and think.

Table 5 about here

The verb know occurred more often in the mental state function and the idiomatic expression function than any other verb across the four groups, as well as occurring in

Table 5

Total number of mental verbs used by each group*

Verb	Non-handicapped	Higher autistic	Lower handicapped	Mentally handicapped
know	83	83	48	35
think	25	33	5	9
guess	14	18	2	0
mean	2	11	0	4
understand	7	4	0	0
decide	7	2	0	1
worry	1	7	0	0
forget	3	2	0	2
hope	2	1	2	2
remember	2	3	1	1
wish	3	3	1	0
figure	5	1	0	0
suppose	2	4	0	0
wonder	0	4	0	1
expect	3	0	0	0
imagine	2	0	0	0
reckon	0	2	0	0
recognize	1	1	0	0
trust	1	1	0	0

Table 5 (cont.)

accept	1	0	0	0
agree	1	1	0	0
assume	1	0	0	0
disagree	1	0	0	0
doubt	0	1	0	0
learn	1	0	0	0
perceive	0	1	0	0
prefer	0	1	0	0
realize	1	0	0	0
recall	0	1	0	0

*in descending order by total number used

the modulation of assertion function for the higher functioning autistic group and the nonhandicapped group. As shown in Table 6, think and guess were predominantly used for directing interaction. Only mean was used in the function of clarification. Because the clarification function occurred infrequently in all groups, it is excluded from further discussion.

Table 6 here

Use of mental verbs in the different functions

Nonhandicapped versus higher functioning autistic

For the nonhandicapped and the higher functioning autistic participants, distributions were such that it was possible to compare the frequency of use of mental verbs using t-tests. As shown in Table 7, there was no difference between the higher functioning autistic (mean=12.27; SD=11.68) and nonhandicapped (M=11.27; SD=8.16) groups on total number of mental verb tokens used, or on the percentage of mental verbs used per utterance (autistic M=7.16; SD=4.60; nonhandicapped M=8.79; SD=3.88). However, the percentage of mental verbs per utterance used to describe mental states was significantly lower for the higher functioning autistic participants than the

Table 6

Mental verbs used in each function

Function	Mental verbs
mental state	know, think, mean, forget, remember, guess, hope, wonder, wish, figure, understand, trust, decide, accept, realize, doubt, worry, recognize, disagree, agree, expect, prefer, learn
modulation of assertion	know, think, mean, guess, hope, suppose, worry, perceive, assume, reckon
directing the interaction	know, think, mean, guess, hope, wonder, imagine, recall
clarification	mean
idiomatic expressions	know, think, forget

Twenty-nine different mental verbs were used by all participants

nonhandicapped participants (autistic M=2.28; SD=1.55; nonhandicapped M=3.86; SD=1.65; $t(27)=2.65$, $p<0.01$).

Table 7 about here

In comparing the use of the different functions, Chi-squares and Fisher exact scores were used due to the number of zeroes present in the data, which made parametric analysis inappropriate. The number of participants who used a function once or more was compared to the number of participants who never used the function. As shown in Table 8, there was no difference between the higher functioning autistic participants and the nonhandicapped participants in their use of mental verbs for modulation of assertion ($X^2(1)=0.144$, $p<0.50$); directing the interaction, ($X^2(1)=0.6$, $p<0.25$); and idiomatic expressions, ($X^2(1)=0$).

Table 8 about here

Nonautistic mentally handicapped versus lower functioning autistic

Because of the high rate of nonoccurrence of certain functions across the two mentally handicapped (autistic and nonautistic) groups, nonparametric statistics were employed. Chi-square tests or Fisher exact scores were used to compare

Table 7

Use of mental verbs for higher functioning autistic and nonhandicapped participants

(N=15 for each group)

Total number		Higher autistic	Nonhandicapped	Sign. level
Mental verbs (MV) used	M	12.27	11.27	
	SD	11.68	8.16	NS
	Range	(2-40)	(0-33)	
Percent of MV used per utterance	M	7.61	8.79 *	
	SD	4.60	3.88	NS
	Range	(2.20-16.36)	(2-15.93)	
Percent of MV used in mental state function per utterance	M	2.28	3.86 *	
	SD	1.55	1.65	$t(27)=2.65$
	Range	(0-5.43)	(1.49-6.93)	$p<0.01$

* N=14 for the nonhandicapped group for this analysis

Table 8

Number of nonhandicapped and higher functioning autistic participants using mental verbs once or more in the conversational functions

(N=15, for each group)

	Higher autistic	Nonhandicapped
Directing interaction	9	11
Modulation of assertion	10	9
Idiomatic expression	10	10

No Chi-square tests were significant

the number of participants in the nonautistic mentally handicapped and lower functioning autistic groups who used a mental verb once or more. The lower-functioning autistic participants were less likely to use any mental verbs to describe mental states than the nonautistic mentally handicapped participants ($X^2(1)=5.00$, $p<0.025$); only 3 out of 15 lower-functioning autistic participants ever used mental verbs to describe mental states, compared to 9 out of 15 of the mentally handicapped participants.

Table 9 about here

When the number of expected occurrences was too small, Fisher exact tests were used to compare the mentally handicapped and lower functioning autistic participants' use of mental verbs in other functions. There were no significant differences of use for the functions of modulation of assertion (Fisher exact, $p<0.155$), directing interaction (Fisher exact, $p<0.305$), and idiomatic expressions ($X^2(1)=0$).

Relationship between use of mental verbs and developmental factors

Spearman rank correlations were run for all groups separately for mental verbs used in each function (i.e.,

Table 9

Number of lower autistic and mentally handicapped participants using mental verbs once or more in all functions

(N=15, for each group)

	Lower autistic	Mentally handicapped	
Total mental verbs used	9	11	
Mental state function	3	9	*
Directing interaction	4	3	
Modulation of assertion	5	2	
Idiomatic expression	9	9	

*$X^2(1)=5.00$, $p<0.025$

mental state, modulation of assertion, directing interaction, and idiomatic expression) with chronological age and mean length of utterance, and for all groups except the nonhandicapped participants, verbal IQ.

Chronological age

As shown in Tables 10 and 11, chronological age correlated highly with mental state function and modulation of assertion for the higher functioning autistic and nonhandicapped groups (higher autistic $r=0.79$, $p<0.01$, $r=0.53$, $p<0.05$; nonautistic, $r=0.69$, $p<0.01$, $r=0.61$, $p<0.05$, respectively). Chronological age also correlated negatively with the idiomatic expressions function for the higher functioning autistic group ($r=-0.56$, $p<0.05$). Chronological age did not correlate significantly with any other function for any other group.

Tables 10 and 11 about here

Mean length of utterance

Mean length of utterance was highly correlated with the mental state function for all but the lower functioning autistic group (higher autistic, $r=0.82$, $p<0.01$; nonautistic, $r=0.77$, $p<0.01$; mentally handicapped, $r=0.63$, $p<0.02$). Mean length of utterance also correlated with

Table 10

Spearman correlations for higher functioning autistic participants

Function	Chronological age	Verbal IQ	Mean length of utterance
Mental state	0.79***	0.70***	0.82***
Modulation of assertion	0.53*	0.46	0.41
Directing interaction	0.45	0.39	0.38
Idiomatic expression	-0.56*	-0.62*	-0.35

* significant at $p<0.05$

** significant at $p<0.02$

*** significant at $p<0.01$

Table 11

Spearman correlations for nonhandicapped participants

Function	Chronological age	Mean length of utterance
Mental state	0.69***	0.77***
Modulation of assertion	0.61*	0.42
Directing interaction	0.31	0.44
Idiomatic expression	0.30	0.26

* significant at $p<0.05$

** significant at $p<0.02$

*** significant at $p<0.01$

modulation of assertion for the mentally handicapped group ($r=0.59$, $p<0.05$).

Verbal IQ

As shown in Tables 10 to 13, for the higher functioning autistic participants, lower functioning participants and the mentally handicapped participants, high positive correlations were found for verbal IQ and use of mental verbs in a mental state function (higher autistic $r=0.70$, $p<0.01$; lower autistic $r=0.59$, $p<0.05$; and mentally handicapped $r=0.52$, $p<0.06$). Because only three lower functioning autistic participants ever used mental verbs in mental state functions, care must be taken in interpreting this result. As well, for the higher functioning autistic participants, a negative correlation for verbal IQ and the idiomatic expression function was found ($r=-0.62$, $p<0.05$). In contrast, for the lower functioning autistic participants, a positive correlation was found between idiomatic use and verbal IQ ($r=0.72$, $p<0.01$). No other significant correlations were found between verbal IQ and the different functions.

Tables 12 and 13 about here

Multiple regressions

Multiple regressions introducing age, then verbal IQ or

Table 12

Spearman correlations for lower functioning autistic participants

Function	Chronological age	Verbal IQ	Mean length of utterance
Mental state	0.26	0.59*	0.18
Modulation of assertion	0.04	-0.19	0.47
Directing interaction	-0.19	0.32	0.45
Idiomatic expression	0.34	0.72***	0

* significant at $p<0.05$

** significant at $p<0.02$

*** significant at $p<0.01$

Table 13

Spearman correlations for mentally handicapped participants

(N=15)

Function	Chronological age	Verbal IQ	Mean length of utterance
Mental state	0.30	0.52*	0.63***
Modulation of assertion	0.46	0.26	0.59**
Directing interaction	-0.30	-0.15	0.41
Idiomatic expression	0.25	0.01	0.26

* significant at $p<0.06$

** significant at $p<0.05$

*** significant at $p<0.02$

mean length of utterance were run for the higher functioning autistic, lower functioning autistic and mentally handicapped groups. Mean length of utterance, verbal IQ and chronological age together accounted for nearly 86 percent of the variance in use of mental state functions in the high functioning autistic group with chronological age and mean length of utterance providing the largest independent contributions. In the lower functioning group, mean length of utterance, verbal IQ and chronological age together accounted for nearly 37 percent of the variance in use of mental state functions, with verbal IQ providing the largest independent contributions. In the mentally handicapped group, mean length of utterance, verbal IQ and chronological age together accounted for nearly 50 percent of the variance in use of mental state functions with mean length of utterance providing the largest independent contributions.

Lower versus higher functioning autistic participants

Chi square and Fisher exact scores were calculated for each function to compare the differences between the lower and higher functioning autistic groups. As shown in Table 14, significant differences were found for the number of mental verbs used to describe mental states (X^2=16.43, p<p.001); modulation of assertion (X^2=3.33, p<0.05); and directing the interaction (X^2=3.39, p<0.05). No significant

differences were found for the idiomatic expressions function.

Table 14 about here

Mentally handicapped versus nonhandicapped participants

Chi square and Fisher exact scores were calculated for each function to compare the differences between the mentally handicapped and nonhandicapped groups. As shown in Table 15, significant differences were found for the number of mental verbs used to describe mental states (Fisher exact, $p<0.04$); modulation of assertion ($X^2=7.03$, $p<0.005$); and directing the interaction ($X^2=8.57$, $p<0.001$). No significant differences were found for the idiomatic expressions function.

Table 15 about here

Table 14

Number of lower and higher functioning autistic participants using mental verbs once or more in the following functions

(N=15, for each group)

Function	Lower autistic	Higher autistic	Sign. level
Mental state	3	14	**
Modulation of assertion	5	10	*
Directing interaction	4	9	*
Idiomatic expression	9	10	NS

* significant at the $p<0.05$

** significant at the $p<0.001$

Table 15

Number of mentally handicapped and nonhandicapped participants using mental verbs once or more in the following functions

(N=15, for each group)

Function	Mentally Handicapped	Nonhandicapped	Sign. level
Mental state	9	14	*
Modulation of assertion	2	9	**
Directing interaction	3	11	***
Idiomatic expression	5	10	NS

* significant at the $p<0.05$

** significant at the $p<0.005$

*** significant at the $p<0.001$

Chapter V

Discussion

General discussion

Studies of normal children indicate that they begin using mental verbs in their third year of life, first in idiomatic ways and to direct the conversation, then to modulate assertions and describe mental states (Shatz et al., 1983; Bretherton & Beehgly, 1982; Bretherton, McNew & Beeghly-Smith, 1981). Thus language is one of the first "windows" into children's early metarepresentational skills. It has been proposed that autism, a severe developmental disorder beginning in early childhood is marked by a specific disability in metarepresentation (Baron-Cohen, 1990, 1991; Leslie, 1987). This study used samples of the language of autistic children and adults (both higher functioning and lower functioning) with mental ages and language ages exceeding three years, in order to investigate whether mental verbs were employed, and if they were, whether the use was similar to expressive language-matched control groups (nonhandicapped and non-autistic mentally handicapped, respectively).

The results were quite straightforward. The two groups of autistic children and adults did use mental verbs as frequently as their comparison groups; however, the autistic

groups did not use mental verbs to describe mental states as often as their age and language-matched nonautistic peers. There were no differences between matched autistic and nonautistic groups in uses of mental verbs for conversational purposes. This confirms Tager-Flusberg's (1992) findings that younger autistic children used cognitive terms less often than children with Down syndrome. Overall, autistic children do seem to have a specific deficit in the ability to talk about their own and others' mental states (Baron-Cohen, 1990; 1991; Tager-Flusberg, 1992), that goes beyond general language delay and broader pragmatic deficits.

On the other hand, additional factors were found to affect the use of mental verbs to describe mental states. In particular, language ability (mean length of utterance or verbal IQ) was highly correlated with the use of mental state functions in the autistic, mentally handicapped and nonhandicapped groups. As utterances become longer, and language is more complex, the use of verbs to describe mental states increases. This finding is supported by other studies, in which the use of complementizers, an indication of more complex language, was found to be higher in utterances with mental verbs describing mental states than others (Shatz et al., 1983; Tager-Flusberg, 1992). Only 3 out of 15 of the lower functioning autistic participants in

the present study used a mental verb to describe a mental state. These three participants' verbal IQs were between 74 and 78, in the upper limits of this group's IQ range, further suggesting that use of mental verbs to describe mental states is related to language ability. In the two higher functioning groups (normal and autistic), use of mental state functions was also correlated with chronological age, indicating a possible contribution of experience or maturation.

Together, these findings suggest that general skills in expressive language contribute to the use of mental verbs to describe mental states, in addition to cognitive abilities that may be specifically lacking in autism. Eisenmajor and Prior (1992) found verbal mental age to influence higher functioning autistic children's performance on theory of mind tasks. The lower frequency of mental state representation found in persons with autism may represent both a specific cognitive deficit and the influence of language skills delayed more severely than accounted for by levels of mental retardation.

The use of the mental verbs in the conversational functions is also of interest. There were no differences in the use of mental verbs in conversational functions. This finding is surprising since some of the functions, such as modulation of assertion, require pragmatic skills, an area

in which autistic children have been postulated to be particularly deficient (Tager-Flusberg, 1981, 1985). Pragmatic skills have also been found to be strongly associated with passing of the false belief task for theory of mind ability (Eisenmajor & Prior, 1992).

In the higher functioning autistic and nonhandicapped groups, modulation of assertion was found to correlate with chronological age. Assumptions about the listener or a certain degree of knowledge is required by the speaker to decide to strengthen or weaken his/her assertion. Particularly, the higher functioning autistic participants were able to alter their speech. However, because the goal of this study was not to look specifically at pragmatic skills, whether or not the higher functioning autistic participants used the modulation of assertion function in a socially appropriate manner is not clear. Whether these were "scripts" used appropriately or not, is unknown.

Idiomatic expressions showed different relationships with language functioning across the four groups. In the higher functioning autistic group, idiomatic expressions were negatively related to both chronological age and verbal IQ. The older the subjects, the greater their language ability increased, the less often they used idiomatic expressions. This pattern characterizes young, normal children as well (Shatz et al., 1983). In the lower

functioning autistic children, idiomatic expressions correlated positively with verbal IQ, indicating that as their language ability increased, their use of idiomatic expressions increased. Thus, the participants who did not use idiomatic expressions had the lowest verbal IQs and most limited language use. The idiomatic function is one of the first uses of mental verbs seen in young children (Shatz et. al., 1983; Tager-Flusberg, 1992). In fact, all of the 9 out of 15 lower functioning autistic participants who used mental verbs at all (not necessarily to express mental state functions) used idiomatic expressions. The use of mental verbs in idiomatic expressions is also related to language ability, that is, as language ability increases, the need to use idiomatic expressions decreases, and more complex functions, like the mental state function, appear. (It is also important to remember here that some idiomatic expressions were stereotypic in nature.)

Two implications arise from the findings in this study: First, further careful studies of a range of language abilities within autistic participants will be important to our understanding of these asynchronous patterns of development in autism even within the area of language and communication (Tager-Flusberg, 1991; Volden & Lord, 1991). Second, studies of metarepresentational skills in autistic and other participants need to control language level,

ideally beyond simple measures of vocabulary recognition, before alternative hypotheses to the specific cognitive deficit hypotheses can be rejected. Investigations into the theory of mind ability in autism should include a measure of both comprehension and expression of the ability to attribute mental states to oneself and others.

Speculation

How do the findings of this study relate to the three theories discussed earlier? Baron-Cohen's (1990, 1991) theory of mind hypothesis suggests a deficit in theory of mind ability in autism. The finding that autistic individuals used mental verbs less frequently to describe mental states than their comparison groups supports his claim. However, the finding that verbal ability is related to the expressive description of mental states suggests that any investigation into theory of mind ability must take verbal ability into account. Despite the fact that certain theory of mind tasks rely heavily on speech, a number of studies using the theory of mind hypothesis do not adequately address the effects of verbal ability. For example, a task involving second-order attribution asks participants to predict the belief of another child, and then to explain why this child would hold this belief (Baron-Cohen, 1989). Clearly, the task involves verbal

ability. Yet Baron-Cohen does not adequately address the relation of verbal ability to his theory of a deficit in theory of mind ability in autistic children. Also, the measure of verbal ability is verbal mental age assessed by the British Picture Vocabulary Test, a reflection of vocabulary, not true linguistic ability. This is one of my major concerns with the research done in the theory of mind studies: they appear to ignore the language component that may be important in a disorder such as autism, where a deficit is seen in communication. Of course, this does not affect the studies on theory of mind hypothesis in nonverbal autistic individuals, who comprise about half of the autistic population. How nonverbal autistic individuals would perform on theory of mind tasks, and how to assess this are areas for further research.

Ozonoff and colleagues' (1991) suggestion of a combination of primary impairments in autism, in line with their executive functioning hypothesis, is more appealing. The findings of this study suggest that there is a deficit in the ability to describe mental states. Although Ozonoff and colleagues found impairments in some of the theory of mind tasks, they did not find impairment in all of the different theory of mind tasks, therefore suggesting it is not necessarily a deficit. Their finding that autistic individuals have deficits in executive functioning allows

predictions of inconsistencies that have been found in the handicapped populations. If there is a neurological impairment in the prefrontal area of the brain, it may have overall effects in other areas of development, such as language or abilities in the theory of mind hypothesis. More research is needed in this area of neuropsychology.

However, as in the other theory of mind studies, verbal ability in relation to theory of mind hypothesis was not specifically addressed by Ozonoff and colleagues in their study. Although in looking more closely at their results, positive correlations were found between verbal IQ and executive functioning and, verbal IQ and theory of mind tasks in their autistic group (Ozonoff et al., 1991). Ozonoff and colleagues believe autism is a combination of primary deficits of which one is executive functioning. The present study finds that language may also be one of the primary deficits in autism. Ozonoff and colleagues seem to be going in the right direction in considering a combination of primary deficits instead of a specific deficit.

Hobson's (1990a, 1990b, 1991a, 1991b) theory of a deficit in affect and interpersonal relationships suggests that in order to introspect about awareness of mental states one must first have a concept of self. Before a concept of self develops, a concept of others must be formed (Hobson, 1990b). If autistic individuals do not describe mental

states as often as the comparison groups, then it may be because they have not developed a concept of others or of self. Those autistic persons that can describe mental states would be predicted to describe the mental states of others first and then those of themselves, suggesting a developmental trend from others to self. The present study did not investigate whether or not the autistic individuals have a concept of self or to whom the mental states refer. Hobson suggests that the affect deficit causes language impairment, therefore, one can speculate that the use of mental verbs in conversational functions, especially those requiring pragmatic ability, would be predicted to be impaired, due to the social aspect of conversing with others. In the present study, this was not the case.

The three theories presented here are all directed at finding specific or primary deficits to explain the impairments of autism. Whatever is the cause, we know that autistic individuals are socially impaired and this affects their ability to communicate, and, hence, makes it difficult for them to function in the world. Communication in verbal autistic individuals is related to language development, and, therefore, verbal ability in relation to other deficits cannot be ignored. The present author favors Ozonoff and colleagues (1991) theory of a combination of primary deficits because she believes that autism is due to more

than one primary deficit, where language ability is one of them.

Another consideration is the role of syntax on the use of mental verbs. The ability to use various syntactic structures may reflect language complexity and influence frequency of mental verbs and how they are used. For example, one could look more closely at the complexity of language in terms of the kinds of complementizers used. It was found that the frequency and types of verbs used by the autistic participants and their respective comparison groups are the same, but the complementizers used were not investigated in this study. Sentences containing mental verbs to refer to the mental states of one's self or to another would be expected to contain complementizers. For example, "I wonder what it feels like to be pregnant?", or "I think that Susie believes that she is in love with him". It may be that the autistic individuals' language is not syntactically complex enough to produce utterances of mental state reference. Therefore, it may not be an impairment in theory of mind, but an impairment of linguistic ability, specifically of syntax, that results in the autistic individuals referring to mental states less often than their respective comparison groups. Although syntax appears to be unimpaired in the autistic individual (Tager-Flusberg, 1985; 1990), this needs to be further investigated, maybe using

different measures of assessing syntax.

Another linguistic element that needs further investigation is pragmatics. What distinguishes the conversational functions from the mental state function is that the verbs that describe mental states can also be used in pragmatic ways such as to direct the interaction, but the conversational functions cannot be coded as representing mental states. So for the mental verbs used to describe mental states there is a duality of function, but this is not true for the mental verbs used in the purely conversational functions. The relationship of pragmatic skills to the use of mental verbs needs to be investigated more specifically.

Conclusion

In conclusion, although the autistic groups used mental verbs as frequently as their matched comparison groups, and employed them as frequently for conversational purposes, the autistic groups used mental verbs less often to describe mental states than their matched comparison groups. These findings support a primary deficit in autistic children's ability to talk about metarepresentations. Strong relationships between use of mental state functions and language ability suggest that deficits in expressive language are also a factor in this particular phenomenon and

contribute to the unique pattern of language and cognitive ability associated with autism.

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Appendix A

Examples of questions asked by the examiner during the relevant part of the Autism Diagnostic Observation Schedulae (ADOS; Lord et al., 1989)

How is school? What are your favorite subjects?

Do you have time for reading at home? What sorts of books do you like?

What sorts of things does your mother do at work/home?

What makes you happy?

How does it feel when you are happy?

Do you have any friends?

Can you tell me about your friend?

What is special about X ?

What does being a friend mean?

What is your dad like as a person?

What sort of person is X ?

Tell me about X.

Do you have a boy/girlfriend?

In what way is your friendship with X special?

Do you ever think about getting married?

Appendix B

Examples of use of mental verbs

within the context of conversation

(taken directly from transcripts of participants)

(S=subject, E=examiner)

Mental state function

(1)

S No actually my dad's from Winnipeg but he moved out here when he was young and working.

S they both worked at CIL.

E Oh really?

S Yeah imagine that meeting at CIL.

S They were both on the bowling team or something.

(2)

E She's horrible is she I bet

S You don't believe me.

E I don't believe that.

S She is.

(3)

E So can you communicate pretty well that way?

S He doesn't use that anymore.

S I can just understand him now.

S He's not bossy.

E Uhhuh.

S He's not the only one who gets to <u>decide</u> what to do, what you do.

E Uhhuh.

E You both decide.

(4)

S Having kids.

E Having kids.

E And what might not be so good about it?

E What might make it hard?

S If you <u>disagree</u> on something.

E Right.

(5)

E Well, that sounds like fun, Scott.

S But I'm not sure what lake it is.

E Uhhuh.

S Because my camp, Camp HeHoHa, is on Lake Isle.

E Uhhuh.

S I <u>wonder</u> if Sundre has a lake.

E I don't know.

Modulation of assertion function

(1)

S I think we were at the wrong side of the lake or something.

E Mhm.

S Because that's where everyone goes and I guess the fish are scared or something.

E Yeah.

S But we caught something at a lake close to Lac La Biche.

(2)

E How would you describe her as a person?

S She gets worried a lot.

E Oh.

E You guys worry her probably.

S Yeah.

S And I guess she cares a lot for other people.

E Uhhuh.

E Does she work too?

(3)

E Can you tell me who lives at home with you?

S Okay right now let's see, it's just my parents are on holidays right now.

E Uhhuh.

S And my brother just left for Ontario but he'll be back in about three months.

E Uhhuh.

S So I guess it's just myself at home.

E Oh really.

Directing the interaction function

(1)

E And you are friends with her?

S Unfortunately we're not that close anymore at all.

E Yeah.

S There for a while we weren't even speaking to each other but,

S You know what happens.

E Uhhuh.

S We just have a few things to work out, you know.

(2)

S Would you like to talk about something?

E What would you like to talk about?

S Let's

S I know what I want to talk about.

E What?

S Where people travel.

S How about that?

Clarification function

(1)

S She is so light.

S She just gets pulled along.

E Yeah probably

S I mean Kimik weighs more than she does.

E Oh really.

S Kimik's big.

S Kimik weighs about fifty two.

S Megan only weighs forty nine.

Idiomatic expressions function

(1)

E Do you ever feel angry?

S Don't know.

E Don't ever feel cross?

S No.

E what makes you feel cross?

S Don't know.

(2)

E Where would you live?

S I don't know.

E But you could stay somewhere else.

E That's right.

E What other types of things do you think wold be good about being married.

S I don't know.

E What might be difficult?

S I don't know.

VITA

I graduated from Austin O'Brien High School in Edmonton, Alberta in June, 1982. I entered the University of Alberta that fall in the Faculty of Science and completed my Bachelor of Science degree in June, 1985 majoring in Psychology and minoring in Linguistics. I then worked for one year as a rehabilitation worker in a group home for severely mentally and physically handicapped children, and for one year as a teacher's aide for a 15 year old deaf girl in a junior high school. I entered the graduate program at the University of Alberta in the Department of Linguistics in September, 1988. I completed one year of coursework in the program and began working for the summer at the Glenrose Hospital with Dr. Catherine Lord doing research in autism. In September, 1989 Dr. Lord sent me to London, England to work with Professor Micheal Rutter at the Institute of Psychiatry for eight months on an autism project there. Upon returning from London, I continued working as a research assistant for Dr. Lord both in Edmonton, Alberta and Greensboro, North Carolina until September, 1991. I returned to the University of Alberta to complete my coursework, and completed the requirements for my Master of Science degree in Psycholinguistics April, 1992. I am now continuing to work with Dr. Lord in research in autism in North Carolina.

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